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Re: Deployment of Advanced Wireline Services Offering Advanced Telecommunications Capability, CC Docket No. 98-147

Dear Staff:

Rhythms NetConnections Inc. ("Rhythms"), by its attorneys, hereby submits this ex parte presentation in the above-captioned docket to address several of the crucial spectrum management issues identified by the Federal Communications Commission ("Commission" or "FCC") in its *Advanced Services Order*.[1]

In the *Advanced Services Order*, the Commission concluded that it should establish certain rules on spectrum compatibility that will "immediately facilitate the deployment of advanced services. . . ."[2] Rhythms suggests that the Commission's goal can best be accomplished by promulgating specific rules that promote the development and deployment of the greatest number and variety of advanced services, while ensuring that all such services can coexist with one another without the need for special outside plant management techniques. Such rules are necessary because certain ILECs are attempting, through inappropriate and

[1] *Deployment of Wireline Services Offering Advanced Telecommunications Capability*, CC Docket No. 98-147, First Report and Order and Further Notice of Proposed Rulemaking, FCC 99-48 (rel. Mar. 31, 1999) ("*Advanced Services Order*").

[2] *Advanced Services Order* ¶ 66.

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unnecessary technical proposals and restrictions, to limit the deployment of DSL services by CLECs, while favoring the deployment of the particular DSL technology they have chosen to support their own retail advanced services. Properly crafted, spectrum management rules will build on the efforts of industry standards-setting bodies by establishing a procompetitive, technologically-neutral regulatory regime for advanced services.

Background

As stated in the *Advanced Services Order*, one of the Commission's goals in this proceeding is to "adopt additional measures that we expect will further facilitate deployment of competitive services ... [by adopting] certain spectrum compatibility and management rules to allow competitive providers to deploy innovative advanced services technology in a timely manner."[3] To reach that goal, the Commission should address spectrum issues by focusing on the only relevant technical issue – crosstalk. As the Commission noted, crosstalk "*can* result in the degradation of the intended signal."[4] In order to address and assess this risk, the Commission requires a working understanding of the true basis, likelihood and extent of the risk of such degradation. As we discuss below, such harmful signal degradation is unlikely to be experienced with modern DSL technologies.

Crosstalk is present to some degree with all telecommunications services employing copper facilities, including POTS. Crosstalk is an electrical phenomenon that cannot be avoided, given that local loops are deployed in multiple-pair cables, with individual wire pairs placed in close proximity to each other within the cables. However, telecommunications engineers have been aware of the properties of crosstalk for decades, and have engineered metallic loop plant facilities, and the services that use those facilities, to take account of the presence of crosstalk, and to be able to meet design parameters without the need for special outside plant management techniques, such as the segregation or separation of loops based on the service being carried on each loop.[5] Thus, the many different services that use the loop plant "take the loop plant as they find it," and can be deployed on *any* available loop, without regard to other services using loops in close proximity.

This explicit design approach has been carried forward and applied to the design of modern DSL services. The designers and manufacturers of DSL equipment have used sophisticated, efficient and robust transceiver design and line coding techniques. They have accounted for the presence of all existing legacy telecommunications services, carried on unseparated and undifferentiated loop plant facilities. As a result, they have developed

[3] *Id.* ¶ 18

[4] *Id.* ¶ 61 (emphasis added).

[5] As the Commission is already aware, the sole exception to this rule is the legacy first-generation Alternate Mark Inversion ("AMI") T-1s. Because of the high levels of crosstalk presented by AMI T-1s, they are deployed using special practices, such as the separation of the transmit and receive pairs into separate cable bundles, and the use of cable bundles on the outside portion of the feeder cable. The Commission is considering ordering the ILECs to phase out the use of AMI T-1s, which Rhythms supports.

technology that supports high-bandwidth DSL services that perform within design specifications using any available loop, even in the presence of other DSL services.[6]

Beyond efficient and robust design, the chief means by which DSL equipment limits ever-present crosstalk to known and manageable levels is the specification and use of Power Spectral Density ("PSD") masks. PSD masks chart the maximum power and frequency levels that a particular DSL technology will attain, enabling engineers to deploy DSL technologies in a manner that minimizes crosstalk between the DSL and the other technologies deployed within the local loop plant. Any DSL technology deployed within the parameters of its PSD mask will thus not create harmful interference with other DSL technologies, because the DSL design process precludes such a result.[7]

Subcommittee T1E1.4 of Committee T1E1 on Telecommunications has already developed PSD masks for ADSL, HDSL, IDSL and certain SDSL technologies. T1E1.4 is also working on PSD masks for new DSL technologies, and is expected to finalize this work soon. Thus, the key spectrum compatibility tools are already in place. By ordering that all DSL equipment manufacturers and providers adhere to the PSD masks for the DSL technologies they manufacture and deploy, the Commission will ensure that no service will experience harmful interference from other services.

Below, Rhythms discusses other additional measures that ILECs have proposed for controlling and limiting DSL deployment, ostensibly to prevent interference, and we demonstrate that these proposals are ineffective, unnecessary, and have great potential for harmful anticompetitive effect. Among these proposals are "Binder Group Management" and SBC's recent proposal for interpreting the Commission's proposed three-tier test for approving DSL technology deployment.[8]

<u>Binder Group Management Practices Are Unnecessary and Ineffectual</u>

As Rhythms explained in its comments in this proceeding,[9] the so-called "binder group management" or "selective feeder separation" ("BGM/SFS") loop segregation practices proposed by certain ILECs and noted in the *Advanced Services FNPRM*[10] are simply a means of perpetrating anticompetitive conduct in the name of network safety. Suggested by ILECs as a way purportedly to ensure compatibility among services deployed on the network, BGM/SFS cannot achieve its claimed benefits, and can only result in restricted availability and decreased consumer choice of DSL services.

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[6] There is no danger of DSL services creating harmful interference with POTS. All DSL equipment must comply with Part 68 rules, which preclude such interference. Moreover, some DSL technologies, such as ADSL and RADSL, use frequencies completely separate from those used by analog POTS.

[7] This result should not be surprising. DSL equipment manufacturers have no incentive to commit economic suicide by selling a product that will create harmful interference with other advanced data services.

[8] The Commission proposed a three-tiered approach for deeming DSL technologies presumptively safe for deployment. *Advanced Services Order* ¶¶ 67-68.

[9] CC Docket 98-147, Rhythms Comments at 23-24 (June 15, 1999); Rhythms Reply Comments at 32-34 (July 22, 1999).

[10] *Advanced Services FNPRM* ¶ 86.

As Rhythms and other parties have explained, and as we reiterate above, DSL technologies have been expressly designed to operate within the network at design service levels without disturbing other technologies. Indeed, Subcommittee T1E1.4 has already promulgated standards for ADSL, IDSL, HDSL and certain levels of SDSL services that address crosstalk by limiting transmission power. Final standards for all remaining DSL technologies are expected to issue following Subcommittee T1E1.4's next session in October. Thus, the Commission's consideration of the necessity and efficacy of BGM/SFS or any similar program must be predicated on the understanding that, far from being unknown or untested technologies, DSL services are tested and standardized for widespread network deployment.

According to the ILEC supporters of BGM/SFS, chiefly (and perhaps only) SBC,[11] BGM/SFS would enable ILECs to reduce the effects of crosstalk from other DSL services on ADSL (which, not coincidentally, is the sole DSL technology used by SBC for its retail advanced services). This reduction in crosstalk would supposedly be accomplished by dedicating certain "binder groups" for use only by ADSL. Other types of DSL would be prohibited from these ADSL-only "binder groups."

However, the BGM/SFS program currently under deployment by SBC completely violates the theoretical underpinnings of the program. Under SBC's theory, other types of DSL should not be deployed in the same *binder group* as ADSL. To have any validity whatsoever, the SBC BGM/SFS program must be able to identify with precision which loops are in which binder groups. However, as the Bell Atlantic T1E1.4 contribution makes clear, ILEC loop assignment and tracking systems *do not* inventory loops according to binder group. Rather, these systems inventory loops by cable and pair number, because there was never any need to know binder group information for purposes of loop pair assignments.[12] Thus, SBC's use of existing loop assignment data as the basis for its BGM/SFS program is fundamentally and fatally flawed.

Moreover, even if the ILEC loop assignment and tracking systems did contain information that precisely identified binder group assignments for each loop, the Bell Atlantic contribution makes it clear that ILECs have not maintained and do not maintain binder group integrity as they spliced and continue to splice cables during original installation and subsequent maintenance activities. Thus, the proximity of any particular pairs carrying DSL services may change at various points in the cable run, from adjacent to non-adjacent, or vice versa.[13]

More invidious than its faulty technical basis, however, is the tremendous potential for anticompetitive uses of BGM/SFS. First, any segregation and reservation by DSL type automatically reduces the number of pairs available for use by all DSL services, because some loops in the reserved pair range will go unused, but will be unavailable for use by other DSL technologies. Second, reservation of pairs for use only for ADSL ensures that SBC's retail ADSL services will have first choice and an assured supply of available clean copper loops, and

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[11] Bell Atlantic actively rejects the validity of BGM/SFS, and articulated its position in a contribution filed with Subcommittee T1E1.4 in February 1999. See Attachment 1.

[12] *Id.*

[13] *Id.*

that other DSL technologies will be forced to use whatever pairs are left. Third, the number of all-copper loops is decreasing as ILECs deploy more and more fiber feeder systems. This development particularly affects DSL-based CLECs that rely on copper loop availability in order to provide services. Moreover, this constraint affects CLECs to a far greater degree than ILECs, because ILECs deploy their ADSL services on the same loops used for existing POTS services, while CLECs are forced to use a separate, additional loop for DSL-based services. Any one of these factors is cause for concern, but in concert, these factors create the clear likelihood of harm to consumers because they will be denied the benefits of a fully competitive market for DSL services.

The Commission should therefore adopt a rule such as the one proposed below that prohibits ILECs from employing BGM/SFS to restrict the ability of CLECs to deploy DSL types other than those offered by ILECs themselves. The only service for which binder group segregation is technically justified is AMI T-1 service, because of its severe crosstalk characteristics. Thus the Commission should permit ILECs to continue to utilize this practice for this legacy technology only. However, the Commission should also order the ILECs to phase out the use of AMI T-1s entirely within three years.

The Commission Should Interpret Its "Successfully Deployed" and "Significantly Degrade" Tests to Encourage the Broadest Possible DSL Deployment While Ensuring Compliance with Industry Standards

The Commission's three-tiered approach to declaring a DSL technology presumptively deployable provides a valuable framework for creating predictable and procompetitive results. In this approach, the Commission first determines that any DSL technology that has been approved by it or any state commission is presumed acceptable for deployment.[14] Second, the Commission finds that any DSL technology for which a PSD mask has been approved is presumed acceptable for deployment.[15] Finally, the Commission's approach deems that any DSL technology that has been "successfully deployed by any other carrier without significantly degrading the performance of other services" is presumed acceptable for deployment."[16]

The third part of the Commission's approach, relying on the terms "successfully deployed" and "significantly degrade," requires interpretation to provide practical guidelines for application. For the one hundred years before they faced competition, the ILECs employed a proven and reliable process for determining whether a new technology has been "successfully deployed" without "significantly degrading" the network. Rhythms suggests that the Commission interpret its "successfully deployed /significantly degrade" test by adopting this ILEC traditional test procedure.

ILECs first test a technology in a laboratory, and then the service is deployed in a single central office for practical network testing. If the service does not cause harmful interference with other services in that central office test, it is deemed suitable for deployment throughout the

[14] *Advanced Services Order* ¶ 67.
[15] *Id.*
[16] *Id.*

network. This practice is as viable for DSL-based services as it is for voice services. The Commission therefore should adopt a rule such as the one proposed below that allows CLECs to demonstrate the technical compatibility of new DSL services with ILEC networks by selecting a single central office for testing. Once the CLEC demonstrates the new DSL service will not cause harm in that central office, the service should be deemed deployable in any central office in any ILEC region.[17]

In addition to this interpretation, Rhythms urges the Commission to adopt a rule that presumes that any proposed service deployed according to its PSD mask and manufacturer's guidelines is acceptable for deployment. Such a rule would ensure network compatibility and quality of service without subjecting carriers to an expensive, lengthy and cumbersome testing process.

Not surprisingly, when faced for the first time with competitive deployment of new technologies, ILECs have proposed novel interpretations that their own prior technology rollouts would never have met. For example, one ILEC, SBC, has attempted to provide an interpretation of these terms that is far more stringent than any test it ever imposed on itself, far more stringent than is required, and that departs from standard industry practices. For example, SBC suggests that a service be deemed "successfully deployed" if it meets four criteria: (1) a minimum of 200 such DSL loops have been deployed; (2) the technology has a minimum 25% penetration rate within a single pair range; (3) the technology has been deployed for at least 30 days; and (4) the CLEC provides information as to the electrical characteristics of the proposed DSL technology. This test is unproven, sets unreasonably high success criteria and would substantially impede innovation in DSL technology.

ILECs have also suggested that the "significantly degrade" test be interpreted to mean that the DSL technology: (1) causes other services not to work as indicated in the service's tariff; (2) causes the service not to work as indicated in a contract or agreement with the customer; (3) significantly reduces the distance over which another technology may be deployed; (4) significantly interferes with or precludes the provisioning of other tariffed or approved services; or (5) significantly reduces available spectrum for other tariffed or approved services. None of these tests relates to any legitimate technical issue concerning harmful crosstalk. Instead, they are designed to support and protect the ILECs' chosen services.

The suggested interpretations of the Commission's rules would stifle technological innovation and are entirely unnecessary, given the realities of xDSL technologies as recognized by industry standards bodies. The "successfully deployed" test suggested by the ILECs creates an overly high threshold requiring widespread deployment of DSL, at the same time that ILECs are successfully slowing the deployment of DSL by CLECs by delaying access to loops and collocation. The "significantly degrade" tests suggested by ILECs would not successfully identify disturbers and would likely limit or preclude other types of DSL technology – most likely those not chosen for deployment by ILECs. The criteria suggested by ILECs are

[17] Any equipment differences between central offices in various ILEC service territories are irrelevant, as DSL services are not provided through central office switching equipment.

unnecessary, because, as discussed above, all DSL equipment is designed and implemented to coexist with legacy services.

Subcommittee T1E1.4 Is Not an Appropriate Forum
in Which to Seek Competitively Neutral Spectrum Polices

Subcommittee T1E1.4 to date has been the only domestic public forum for the development of DSL engineering standards and practices. Indeed, Rhythms has recognized the value of Subcommittee T1E1.4's progress in adopting DSL standards.[18] Rhythms also, however, recognizes that due to resource constraints that limit the ability of CLECs to participate as broadly, ILECs may exercise undue influence over the results of such subcommittees. Recent developments within Subcommittee T1E1.4 confirm this suspicion.

Subcommittee T1E1.4 has the task of determining which DSL technologies are designed such that they may be deployed freely in the network without fear of interference. Approved DSL technologies, which will join the list of "guarded services" that includes POTS services, will be presumptively safe and their deployment cannot be impeded on the basis of network safety concerns. In effect, the Subcommittee is picking the "winners" in DSL. Unfortunately, ILEC services are winning.

One clear example of this phenomenon is the Subcommittee's recent decision to establish HDSL-2 as a "guarded service" on a greatly expedited basis. HDSL-2, a symmetrical high-speed data service operating at 1.544 Mbps, is provisioned on 2 wires instead of the traditional 4-wire deployment for HDSL, and is strongly supported by ILECs. A "guarded service" is one that is unrestricted for deployment and is protected from interference from all new advanced services. Historically, a service must have an approved PSD mask or already be widely deployed in the network to qualify as a "guarded service." However, due to an amendment strongly backed by ILECs, HDSL-2, which has yet to be deployed, will be established as a "guarded service" because of the ILEC amendment allowing such status for services that *will in the future be widely deployed.* Thus, HDSL-2 is now completely protected even before its deployment begins. This decision is extremely suspect and is evidence of a disturbing trend within T1E1.4. As Rhythms stated in its reply comments, "T1E1 is currently 'captured' by ILECs."[19]

For these reasons, Rhythms encourages the Commission to adopt a rule such as the one proposed below that defines the Commission's participation in Subcommittee T1E1.4. More importantly, the Commission should evaluate independently the decisions and procedures of T1E1.4 to determine whether the standards it determines are technology- and provider-neutral. Ultimately, the Commission should feel confident in its authority to reject skewed or unprincipled results that come from T1E1.4 and refuse to subject the DSL industry to unfair standards. Rhythms is confident that the Commission's attendance and participation to date in

[18] Rhythms Comments at 17; Rhythms Reply Comments at 39.
[19] Rhythms Reply Comments at 37.

Subcommittee T1E1.4 indicates that it will safeguard advanced services competition in this manner.

Proposed Rules

Rule 51.xxx Use of loops for advanced services.

(a) Any of the following loop technologies are presumed acceptable for deployment:

(i) Any loop technology that has been approved by the Commission, any state Commission or an industry standards body;

(ii) Any loop technology that complies with existing industry standards, including the power spectral density mask in such standards; or

(iii) Any loop technology that has been successfully deployed by any carrier without significantly degrading the performance of other services. A telecommunications carrier demonstrates successful deployment of a loop technology to the Commission or any State Commission by showing that such loop technology has been deployed in at least one central office designated by that carrier. A loop technology shall be deemed to be successfully deployed if it has operated on at least 25 loops for 30 days without significantly degrading the performance of other advanced services. A telecommunications carrier asserting that a loop technology is causing significant degradation shall demonstrate to the Commission or the State Commission in which deployment of this loop technology is proposed that the loop technology has significantly degraded the performance of other services. A demonstration of significant degradation shall require a showing that this loop technology has reduced the achievable data rate of other advanced services by 20 percent or more, where those other advanced services have been deployed according to industry standards.

(b) An incumbent LEC shall assign loops for DSL services on a first come, first served basis, without regard to the type of DSL being offered. With the exception of loops used to provide AMI T-1 service, the incumbent LEC shall be prohibited from designating, segregating or reserving particular loop wire pairs or pair ranges for use by any particular service or high speed data technology, via the use of binder group management, selective feeder separation, or any other techniques. Any existing binder group management, selective feeder separation or any other techniques shall be discontinued and dismantled within 60 days of the enactment of this rule. Incumbent LECs may utilize binder group segregation for AMI T-1 service. However, incumbent LECS shall phase out use of AMI T-1s entirely within three years from the date of enactment of this rule.

(c) The Commission shall appoint a representative to participate in and monitor the activities of ANSI Subcommittee T1E1.4. The Commission shall independently evaluate the decisions and procedures of Subcommittee T1E1.4 to ensure standards are technology- and provider-neutral. The Commission retains authority to modify or reject any decision or procedure of Subcommittee T1E1.4 that it deems to be anticompetitive or otherwise intended to or likely to result in standards that benefit one type of DSL or other advanced service technology over another.

Conclusion

The Commission's decisions with regard to DSL technology standards-setting and spectrum management practices will in large part determine the viability and scope of advanced services competition in the United States. Rhythms encourages the Commission to promulgate, in its forthcoming Order, rules that include those proposed herein. Such rules will result in procompetitive, technology-neutral spectrum management policies. Rhythms looks forward to continuing to assist the Commission in this endeavor.

Sincerely,

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ATTACHMENT 1

Bell Atlantic Comments to Subcommittee T1E1.4

February 1999

COMMITTEE T1 – TELECOMMUNICATIONS
Working Group T1E1.4 (DSL Access)
Orlando, Florida; February 1-5, 1999

CONTRIBUTION

TITLE: **Binder Group Segregation is not Feasible**

SOURCE: **Bell Atlantic**

PROJECT: **T1E1.4, Spectral Compatibility**

Abstract

This contribution argues that binder group segregation is neither practical nor feasible for mass market technologies and should neither be required nor recommended in order to demonstrate spectral compatibility using the analytical method (Method B) to be defined in the spectrum management standard currently under development in T1E1.4.

I.

II. INTRODUCTION

Services and transmission system technologies must coexist, and be compatible with, other services and transmission technologies that operate in the local loop environment. In order to achieve spectral compatibility, energy that transfers into a loop pair, from services and transmission system technologies on other pairs in the same cable, must not cause an unacceptable degradation of performance. In addition, energy in a particular loop pair must not transfer into other pairs in a manner that causes an unacceptable degradation in the performance of services and technologies on those pairs.

Electromagnetic energy that couples into a metallic cable pair from services and technologies on other pairs in the same cable is called crosstalk. The amount of crosstalk depends upon the exposure or proximity of metallic pairs. The greater the exposure, the greater the total crosstalk power.

Binder group segregation is a spectrum management tool that attempts to control crosstalk by increasing the physical distance between different types of technologies in a loop cable. Since it is impossible to predict the exact amount of exposure between any two pairs in a loop cable, this contribution argues that binder group segregation for mass market technologies should neither be required nor recommended in order to demonstrate spectral compatibility using the analytical method (Method B) soon to be defined in the spectrum management standard.

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NOTICE

This contribution has been prepared to assist Standards Committee T1-Telecommunications. This document is offered to Working Group T1E1.4 as a basis for discussion and is not a binding proposal on Bell Atlantic. The proposed requirements are subject to change in form and numerical value after more study. Bell Atlantic specifically reserves the right to add to, amend, or withdraw the statements contained herein.

Binder Groups and Pair Units

A binder group is a pair unit or a multiunit that has been assembled together and bound with colored binder tape for identification. A pair unit may consist of 12, 13, or 25 pairs. A multiunit consists of subunits that have been assembled together into a collection of 50 or 100 pairs. For example, a 50 pair multiunit can consist of two 12 pair subunits and two 13 pair subunits and a 100 pair multiunit can consist of four 25 pair subunits. So, the most common binder group sizes are 12, 13, 25, 50, or 100 pairs.

Crosstalk Coupling Loss

The amount of loss between any two pairs in a cable is called the crosstalk coupling loss. It is generally believed that, in any section of cable, the crosstalk coupling loss between pairs in the same binder group is less than the crosstalk coupling loss between pairs in adjacent binder groups. It is also believed that the crosstalk coupling loss between pairs in adjacent binder groups is less than the crosstalk coupling between pairs in non-adjacent binder groups. These assumptions are based on the fact that the crosstalk coupling loss, at any particular frequency, decreases as exposure increases. Exposure is a measure of the proximity of metallic pairs at various points along a cable run and the length over which pairs are in close proximity.

In early spectral compatibility work involving metallic interoffice facilities, the terms "***same binder group***", "***adjacent binder group***", and "***non-adjacent binder group***" had some basis in reality and were used to describe the actual degree of physical proximity and the expected crosstalk coupling performance. Loop facilities are much different than interoffice facilities however because they do not generally have binder group integrity. That is, the continuity of binder groups and the relationship of binder groups is not maintained in most loop cables.

III. NON-ADJACENT BINDER GROUPS

The loop plant generally consists of large feeder cables near the Central Office (CO) with successive cables becoming smaller and smaller the farther you get from the CO. The smallest cable used for a loop is usually the cable going to the terminal that serves the customer location. Although metallic cables are manufactured with pairs twisted together into pair units or binder groups, no attempt is made to maintain the relationship of one binder group to another binder group when loop cables are spliced together. This means that in the loop environment the terms "***adjacent binder group***" and "***non-adjacent binder group***" can rarely be used with confidence.

Binder groups that were non-adjacent in one cable section may become adjacent in the next cable section after passing a splice point. This often occurs in loop plant when some of the pairs of a large cable are spliced into a smaller cable that has fewer "non-adjacent" binder groups. Table A shows that the percentage of pairs that can be considered to be in non-adjacent binder groups decreases as the cable gets smaller. This means that while we may begin at the CO in non-adjacent binder groups, the likelihood of loop pairs remaining in non-adjacent binder groups decreases as the cable size gets smaller.

Assume that 300 pairs of a 900 pair cable consist of three 100-pair binder groups (call these binder groups A, B, and C) and that binder group A is adjacent to binder group B and non-adjacent to binder group C (see Figure 1). If these pairs are spliced into a 300-pair cable (see figure 2), the three 100-pair binder groups will be spliced into six 50-pair binder groups. There is no way to join these cables so that all of the pairs that were in non-adjacent binder groups in the 900-pair cable will remain in non-adjacent binder groups in the 300-pair cable. (Most methods of splicing these cables together will result in no pairs in non-adjacent binder groups but by careful binder group selection, as illustrated in Figure 3, 50 pairs could end up in non-adjacent binder groups.) Normally a technician would not have made such an effort to select binder groups in this fashion since this is not a requirement for POTS loops. In addition, no record is kept of how the dissimilar cables were spliced together so the fact that 50 pairs did or did not maintain their non-adjacent relationship would not be known. Under these circumstances, the only prudent thing, in this example, would be to assume that none of the pairs in the 300-pair cable were in non-adjacent binder groups.

Since the loop plant was designed to support voicegrade services, there was no requirement to maintain the relationship of binder groups when loop cables were spliced together. So in the loop environment, it is very rare to find two binder groups, that serve the same customer location, that would truly qualify as being "***non-adjacent***" and, if you actually had non-adjacent binder groups, you may not know it because there is no record of it.

IV. ADJACENT BINDER GROUPS

When the loop plant was built, no attempt was made to maintain the relationship of pairs in a particular binder group to other pairs in the same binder group. Thus, in the real-world loop environment the terms "***same binder group***" and "***adjacent binder group***" cannot be used with confidence. Pairs that are in adjacent binder groups in one cable section may end up in the same binder group in the next cable section after passing a splice point. Likewise, pairs that are in the same binder group may end up in different binder groups after a splice. This often happens in the loop plant when pairs in a large binder group in one cable are spliced into smaller binder groups of another cable.

For example, assume that a pair begins in a 12 pair subunit of a 50-pair cable at the customer's serving cable terminal. It is considered to be adjacent to three other subunits (like the 50-pair multiunit shown in Figure 2). When this 50-pair cable is spliced into a 100-pair cable, the 12 pair subunit and another 13 pair subunit will be combined and spliced into a 25 pair subunit (like the 100-pair multiunit in Figure 1). Thus, the adjacent binder groups have become the same binder group. When the 100-pair cable is subsequently spliced into a 300-pair cable, that 25-pair unit and another 25-pair unit will be combined and spliced into a 50 pair multiunit. Again, two binder groups have become one binder group. When the 300-pair cable is subsequently spliced into a 900-pair cable, the 50-pair multiunit and another 50-pair multiunit will be combined and spliced into a 100 pair multiunit. So, several pairs that started out in separate binder groups have ended up in the same binder group.

Another problem that impacts binder group integrity, is that over the years no attempt has been made to maintain the relationship of pairs in the same binder group during maintenance activities since the primary objective is continuity not high frequency crosstalk coupling. So again, pairs that started out in different binder groups may end up in the same binder group after maintenance activity.

Since no record has been kept of exactly how every splice or repair was accomplished, the relationship between the pairs inside of a loop cable cannot be discerned from cable records.

Since the loop plant was designed to support voicegrade services, there was no requirement to maintain the relationship of binder groups when loop cables were spliced together. So in the loop environment, it is very rare to find two binder groups serving a customer location that would truly qualify as being "***adjacent***" and, if you actually had adjacent binder groups, you would not know it because there is no record of it.

V. LOOP ASSIGNMENT SYSTEMS

Existing loop assignment systems can identify the cables and pairs that appear in the cable terminal serving a particular customer location. These systems can automatically assign a spare pair (if one exists) for a most services, but they cannot segregate services by binder groups. Loop assignment systems would require costly modifications in order to provide the capability to identify the binder groups that appear in the cable terminal serving a particular customer location, identify the permissible technologies, and automatically assign a spare pair. Even if such system modifications were made however, the lack of binder group integrity makes binder group segregation on a large scale impractical.

Even if support systems could assign by binder group type, which they cannot, how would such information be determined? As mentioned earlier, no record is kept on how cables are spliced together. The information does not exist.

VI. SPECTRUM MANAGEMENT LOOP ASSIGNMENT GUIDELINES

Binder group segregation in the form of loop assignment guidelines are sometimes used in an attempt to manage the proximity of incompatible technologies. Incompatible technologies are assigned to pairs that the carrier believes are in different binder groups. Since cable records and loop assignment systems cannot determine the amount of exposure between any two pairs in a cable when new services are assigned a loop pair, loop assignment guidelines are often limited to mitigating interference problems after they are discovered. In these maintenance situations, it is assumed that, where interference exists, there must be a good deal of exposure. Decreasing the amount of exposure can be an effective spectrum management tool however the effectiveness is limited by the lack of binder group integrity and the fact that the likelihood of having adjacent or non-adjacent binder groups available at the customer's serving cable terminal is quite small.

Conclusion

Binder group segregation can be an effective spectrum management tool for a carrier in certain limited situations. It is up to each carrier to determine the situations where it would be practical.

Since it is impossible to predict the exact amount of exposure between any two pairs in a loop cable, binder group segregation is not feasible for mass market technologies and should neither be required nor recommended in order to demonstrate spectral compatibility using the analytical method (Method B) soon to be defined in the spectrum management standard.

The only reasonable and practical way to conduct crosstalk margin evaluations is to use statistical exposure models that simulate real-life conditions (i.e., pairs that are in the same binder group). If different technologies are compatible when evaluated using same binder group crosstalk coupling factors, then the technologies will be compatible when they are in different binder groups.

Table A: Percent of Non-Adjacent Binder Groups for Various Cable Sizes

No. of Pairs in Cable	No. of Binder Groups	Percent of Non-adjacent BGs
50	4	0
100	4	0
150	5/1	33
200	6/1	37.5
300	5/1	33
400	6/1	37.5
600	9/3	50
900	7/2	44
1200	9/3	50
1500	9/6/1	60
1800	12/5/1	78
2400	13/8/3	75

Figure 1 - 900 pair cable
(nine 100-pair multiunits)

Figure 2 - 300 pair cable
(six 50-pair multiunits)

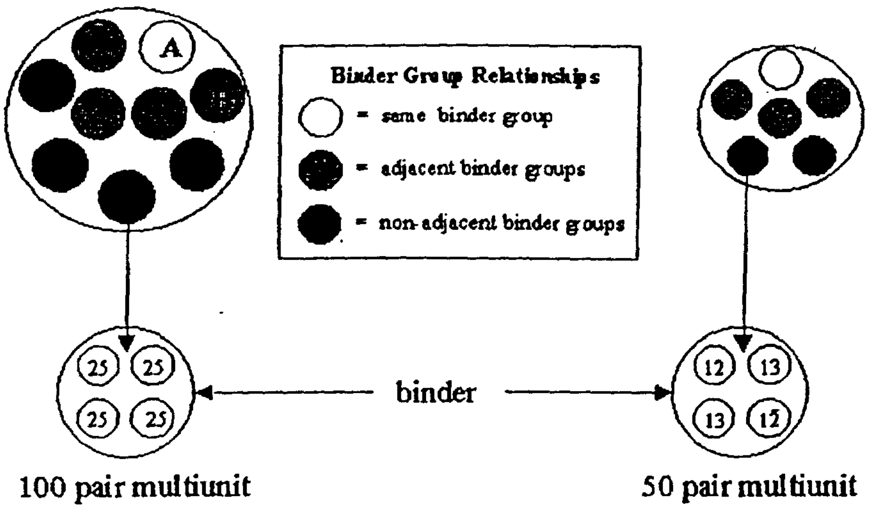

Figure 3 - Splicing 100 pair units to 50 pair units